



Friday, November 08, 2002

Office of Administration
Attn: Rules and Directives Branch
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555-0001

9/6/02
64 FR 57044
③

RECEIVED
2002 NOV 14 PM 3:57
Rules and Directives
Branch
ENR

Dear Staff:

Subject: **Comments on Draft Regulatory Guide DG-1119**

Attached please find comments and feedback on Draft Regulatory Guide DG-1119, "Guidelines for Evaluating Electromagnetic and Radio-Frequency Interference in Safety-Related Instrumentation and Control Systems." These comments were generated by the EPRI EMI Working Group, which over the last several years has guided the development of the EPRI guidelines on this subject, specifically TR-102323, "Guidelines for Electromagnetic Interference Testing in Power Plants," 1994, and its subsequent revisions.

The staff is to be commended for working to remove excess conservatism from earlier guidance and provide greater flexibility in demonstrating reasonable assurance that equipment going into the plants will be electromagnetically compatible with the plant environments. However, there are areas where we believe this draft guidance should be refined before the next revision to Regulatory Guide 1.180 is published, and these are described in the detailed comments that follow.

You will notice that several of the comments are attempting to reconcile differences between DG-1119 and EPRI TR-102323 R2, which represents the most recent industry publication on this subject. It appears that there are inconsistencies between the technical bases for the two documents that should be resolved before the revision to Regulatory Guide 1.180 is finalized.

We would be happy to support further discussion of these comments.

Sincerely,

Raymond C. Torok
EPRI
3412 Hillview Avenue
Palo Alto, CA 94304
(650) 855-2776
rtorok@epri.com

Handwritten note: *Handwritten = ADM-013*

Handwritten notes: *E-RIDS = ADM-03*
Add = T.H. Clark (TLC#)
C.E. GATONESCU (CEA)

Draft Regulatory Guide DG-1119, "Guidelines for Evaluating Electromagnetic and Radio Frequency Interference in Safety-Related Instrumentation and Control Systems"

Comments and Feedback from the members of the EPRI EMI Working Group 11/08/02

| # | Subject: | Section/ Page No. | Comments: |
|---|--------------------------------------|--------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1 | EPRI TR-102323 Endorsement | B/Page 5 | It is not clear what is meant by the phrase "both methods." It could refer to one or more of the revisions of EPRI TR-102323 and/or or to one or more of the revisions of Regulatory Guide 1.180 and/or to an SER. |
| 2 | Qualification Impacts | C/Page 8 (3 rd paragraph) | Suggest adding "and other design parameters that may impact the EMI/RFI qualification testing results" to the end of the 3 rd paragraph. |
| 3 | Cameras and other sources of flashes | C/Page 8 (last paragraph) | Cameras and flash attachments generate ultraviolet emissions at 10^{15} - 10^{16} Hz, which are outside the band of traditional EMI/RFI testing programs and should not be included in the scope of this guidance. In addition, licensee events attributable to ultraviolet emissions may be avoided by maintaining protective coverings over EEPROM's and other devices sensitive to ultraviolet emissions. |
| 4 | RFI Exclusion Zones | C/Page 8-9 | Free-space loss for radiated emissions is frequency dependent, as can be seen from a review of the formulas to estimate radio transmission loss. Portable transceivers that transmit in the 2 GHz range and above have a much shorter transmission distance than VHF and UHF (150 MHz and 450 MHz respectively) devices of the same power level. Therefore, it is recommended that guidance be provided or at least an allowance be included in the regulatory guide to address the lower field strengths expected at higher frequencies. This is necessary in order to use the higher frequency devices in control rooms and other sensitive areas, while excluding the lower frequency devices that may cause interference. |
| 5 | MIL-Std-461C / D | C.1.General/Table 1 | Table 1 does not endorse or support older versions of Mil-Std-461C & D. DG-1119 should be revised to state that equipment previously qualified to 461C & D meet the testing requirements, provided the complete scope of susceptibility and emissions testing has been addressed. It should also state that new equipment should be qualified to the endorsed 461E or IEC 61000 series standards. |

| | | | |
|---|-------------------------------|------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 6 | Conducted Emissions/ CE101 | C.3.1/page 13 | <p>DG-1119 specifies a custom limit that differs from 461E and TR-102323 R2 (which both use the CE101-4 limit). The DG-1119 limit appears to model the CE101-2 limit for submarines, and the base limit curve offers some relaxation at lower frequencies, but overall is more restrictive over the 200 Hz – 10 kHz frequency range. The technical basis for this custom limit, which is undesirable, is not clear. EPRI TR-102323 R2 indicates that this more restrictive testing level is not necessary to ensure adequate equipment emissions controls.</p> |
| 7 | Conducted Emissions/ CE102 | C.3.2/page 13-14 | <p>DG-1119 requires this test. TR-102323 R2 provides an exemption for this testing requirement when the design includes power line filtering or other emissions controls on AC power lines to address high frequency conducted emissions. DG-1119 should provide consider provisions that would allow for waiving this testing requirement if design conditions are satisfied.</p> <p>DG-1119 specifies a custom limit that differs from 461E and TR-102323 R2. The DG-1119 limit is more restrictive than both 461E and 102323 R2 over the entire 10 kHz – 2 MHz frequency range. The technical basis for this custom limit, which is undesirable, is not clear and this more restrictive limit is not necessary to ensure adequate equipment emissions controls.</p> <p>For a meaningful endorsement of IEC 61000-6-4, custom limits like those of Table 4 should be avoided and replaced with the limit within the currently approved standard that most closely matches the NRC desired level. In addition, the differences between TR-102323 endorsed standards and DG-1119 standards should be resolved.</p> |
| 8 | Radiated Emissions/ RE101 | C.3.3/page 14-15 | <p>DG-1119 specifies a custom limit that differs from 461E and TR-102323 R2. The DG-1119 limit is more restrictive over the entire 30 Hz – 100 kHz frequency range. The technical basis for this custom limit, which is undesirable, and the additional conservatism is not necessary to ensure adequate equipment emissions controls.</p> |
| 9 | Radiated Emissions/ RE102 | C.3.4/page 15-16 | <p>DG-1119 specifies a custom limit that differs from 461E and TR-102323 R2. The DG-1119 limit is more restrictive over the entire 2 MHz – 1 GHz frequency range. The technical basis for this custom limit, which is undesirable, is not clear and this more restrictive limit is not necessary to ensure adequate equipment emissions controls. In addition the recommended limit does not include controls for frequencies above 1 GHz, which are currently in use and will become more common at several facilities.</p> |

| | | | |
|----|-------------------------------------------------------------------------------|---------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| | | | To add value and provide benefit to the endorsement of IEC 61000-6-4, custom limits like those of Table 5 should be avoided and replaced with the limit within the currently approved standard that most closely matches the NRC desired level. In addition the differences between TR-102323 endorsed standards and DG-1119 standards should be resolved. |
| 10 | Low-frequency Conducted Susceptibility Testing (CS101 & IEC61000-4-13 & 4-16) | C.4.1.1/page 19-20 & 21-24 | Table 7, Section C.4.1.3 and Section C.4.2 specify susceptibility test IEC 61000-4-16. The purpose of this conducted-susceptibility, low-frequency test is to assess immunity to conducted common-mode disturbances from 15 Hz to 150 kHz. There is not an equivalent MIL-STD-461E test (CS109) specified in Table 6 and no basis has been provided for this expanded testing scope. This equivalent test is not required in R.G.-1.180 or EPRI TR-102323 R2. IEC 61000-4-16 should be removed from Table 7 unless adequate justification and basis for needing this test is documented. |
| 11 | High-Frequency Conducted Susceptibility Testing (CS114 & IEC61000-4-6 & 4-16) | C.4.1.2, C4.1.3 and C.4.2/pages 20-26 | <p>DG-1119 specifies a custom limits for both power and signal cables that differ from those of 461E and TR-102323 R2. The DG-1119 limit for power cables is more conservative than TR-102323 R2 over the 10 kHz – 200 kHz frequency range. The DG-1119 limit for signal cables in Table 17 appears to be in error and specifies a limit of 91dBmμA. It is believed that the staff intended for this limit to be 91dBμA. Either way, the DG-1119 limit for signal cables is more conservative than TR-102323 R2 over the entire 10 kHz – 20 MHz frequency range. The technical basis for these custom limits, which are undesirable, is not clear. EPRI TR-102323 R2 indicates that these more conservative limits are not necessary to demonstrate acceptably low equipment susceptibility.</p> <p>To add value and provide benefit to the endorsement of IEC 61000-4-6, custom limits like those of Table 17 & 18 should be avoided and replaced with the Class 2 or 3 limit within the currently approved standard that most closely matches the NRC desired level if possible. In addition the basis for the 134 dBμA limit and relationship between this test and the corresponding RS103 test limit (10 V/m) are unclear.</p> |

| | | | |
|----|------------------------------------------------------------------------------------------------|---------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 12 | High-Frequency Radiated Susceptibility Testing (RS103 & IEC61000-4-3) | C.4.3.2/pages 28-30 | <p>DG-1119 endorses testing in accordance with the RS103 and 61000-4-3 standards to a 10 V/m limit. However, the DG is not clear on what range of testing frequencies apply for testing performed in accordance with the 61000-4-3 standard. The 61000-4-3 test is typically performed from 80 MHz to 1 GHz. DG-1119 needs to specify frequency criteria for 61000-4-3 testing.</p> <p>DG-1119 does not address emission testing above 1 GHz. TR-102323 R2 specifies testing up to 10 GHz to ensure equipment is not affected by the emissions of new devices operating above 1 GHz, which are becoming more popular and common. EPRI is currently gathering and analyzing higher frequency plant data. It might be helpful to incorporate this new data into the revision to the regulatory guide.</p> |
| 13 | Surge Susceptibility Testing (61000-4-12 & 61000-4-5, CS116 or IEEE C62.41-1991 & C62.45-1992) | <p>C.5.1 & C.5.2/pages 31-34</p> <p>C.4.2/pages 24-26</p> | <p>Table 26 and Section C.5.1 specify a ring-wave surge susceptibility test in accordance with IEC 61000-4-12. Tables 16 & 18 and Section C.4.2 also specify a ring-wave surge susceptibility test in accordance with IEC 61000-4-12 for signal lines. There is overlap between this test and the combination waveform of 61000-4-5. The slower rise time and duration of 61000-4-12 result in a less challenging test than the combination wave test (61000-4-5) and it is believed that the combination wave test provides resonance frequencies that better match a power plant environment. Because the 61000-4-5 test is more appropriate, testing in accordance with IEC 61000-4-12 should be removed from DG-1119.</p> <p>Tables 15, 16, 17 & 18 and Section C.4.2 specify surge susceptibility testing in accordance with 61000-4-5 and 12 or CS116 for signal lines. The origin of proposed surges for signal lines within a protected structure in a controlled environment is not clear and until a basis for needing this test is established, it should be deleted and removed from the DG-1119 scope of susceptibility testing. Note that TR-102323 R2 requires this test for shields and ground leads connected to remote (> 30 m) grounds, however does not require this test for signal (I/O, data & control) lines unless they are run externally to structures and outside of conduit.</p> <p>The ring wave surge susceptibility test of IEC 61000-6-12 is missing from Table 7 and should be added if this test is required scope.</p> |

| | | | |
|----|---------------------------------------------|---------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 14 | Radiated Susceptibility Testing Above 1 GHz | C.6/pages 35-36 | <p>DG-1119 notes the need for high frequency, radiated susceptibility testing above 1 GHz. It also notes that RS103 addresses testing above 1 GHz where 61000-4-3 does not. Section C.4.3.2 should be revised to reflect the information of section C.6 to avoid confusion and the perception the RS103 test should end at 1 GHz as opposed to 10 GHz. Section C.6 could then be deleted.</p> <p>In addition Section C.6 does not address high frequency, radiated emissions testing above 1 GHz. DG-1119 should be revised to reflect the need to control emissions above 1 GHz.</p> |
| 15 | References | References/ page 38 | The reference to EPRI TR-102323 is out of date and should refer to Revision 2 published in November 2000. |
| 16 | General | | It is recommended the staff consider adding a comment cautioning licensees on the potentially erroneous acceptance of products that are CE marked. Because there are differences in the scope and specified testing limits of CE marked equipment and equipment qualified in accordance with DG-1119, licensees should carefully review qualification documentation to ensure both the scope and proper testing limits were applied. |
| 17 | General | | The current structure of DG-1119, and in particular the section on signal lines testing, can be confusing and difficult to follow. It is recommended that the staff work to clarify this scope of testing and make it easier for licensees to understand the guidance. It may be helpful to simplify the document by using tables like 5-1 and 5-2 of EPRI TR-102323 R2 and moving backup data into an appendix. |
| 18 | Definitions | Various | In a number of places, the DG allows for exemptions if "power quality control" is used. Is this the same as the power line filtering or other emissions controls on AC power lines to address high frequency conducted emissions that are credited similarly in EPRI TR-102323 R2? It would be helpful to add a definition explaining in more detail what is meant by this term. |

| | | | |
|----|---------|---------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 19 | General | Various | <p>The use of custom test levels that are different from those used in accepted standards should be avoided. For equipment that has already been qualified to industry-accepted levels, custom levels could require additional testing at significant cost, and without commensurate decrease in EMC risk.</p> <p>This could also inadvertently lead to proven, high quality equipment becoming unavailable to the nuclear power industry, with a corresponding adverse impact on safety.</p> |
|----|---------|---------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|